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Kishida

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[54] **INFORMATION PROCESSING SYSTEM**

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Related U.S. Application Data

[63] Continuation of application No. 08/568,320, Dec. 6, 1995, abandoned.

[30] **Foreign Application Priority Data**

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Nov. 30, 1995 [JP] Japan 7-313282

[51] **Int. Cl.**[6] **G06F 15/00**

[52] **U.S. Cl.** **395/114**; 395/112

[58] **Field of Search** 395/114, 112, 395/113, 111, 117, 115, 116, 109, 110, 101, 834–839, 828, 840, 841, 882–884, 892, 893, 894, 104, 102, 107, 108; 358/468, 407, 462, 401, 442, 467; 400/63, 83; 347/142, 2, 3, 5; 710/14–19, 8, 20–21, 62–64, 72–74

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Primary Examiner—Dov Popovici
Attorney, Agent, or Firm—Fitzpatrick, Cella, Harper & Scinto

[57] **ABSTRACT**

The present invention discloses an information processing system comprising a host computer and at least two printers having different interfaces. A page description language or bit map data is received by a printer. When the page description language is received, the printer expands it into bit map data. The expanded bit map data is transferred to another printer via a parallel interface. Thus, the workload of the host computer in its printing process is lessened.

15 Claims, 14 Drawing Sheets

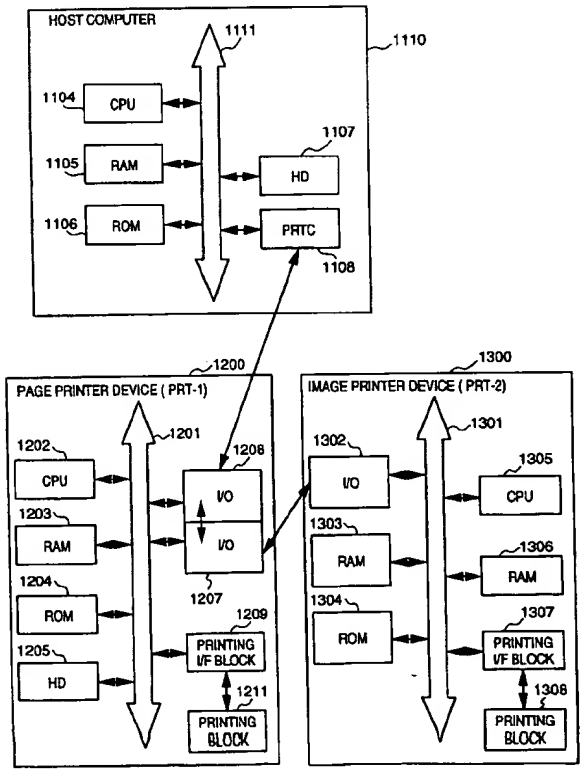


FIG. 1

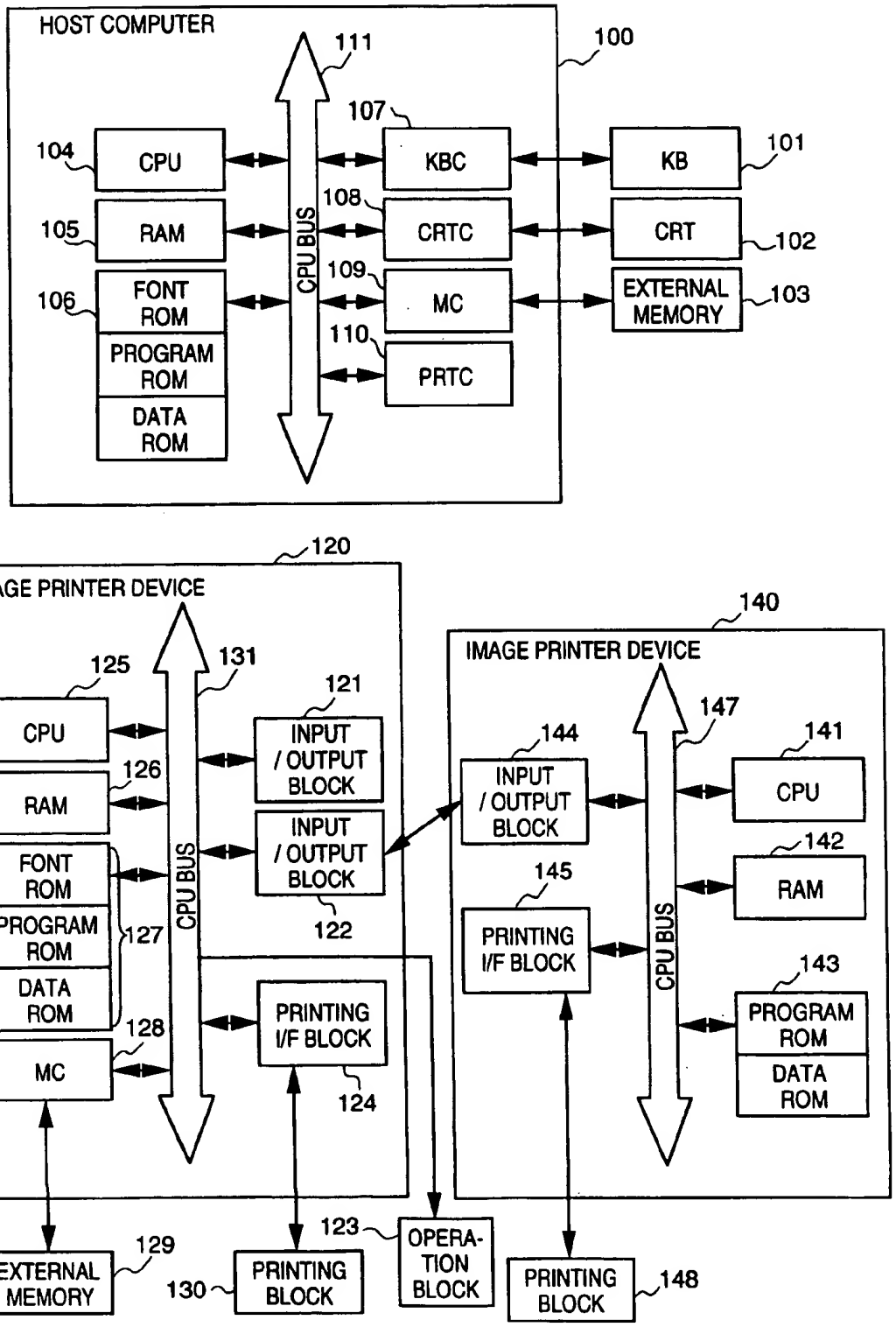

HOST COMPUTER
100
111
107
104
CPU
KBC
KB
101
105
RAM
108
CRTC
CRT
102
CPU BUS
106
FONT ROM
109
MC
EXTERNAL MEMORY
103
PROGRAM ROM
110
PRTC
DATA ROM
120
PAGE PRINTER DEVICE
140
IMAGE PRINTER DEVICE
125
131
121
147
144
141
CPU
INPUT / OUTPUT BLOCK
126
RAM
142
145
FONT ROM
PRINTING I/F BLOCK
127
122
143
PROGRAM ROM
DATA ROM
128
MC
124
123
OPERA-TION BLOCK
129
EXTERNAL MEMORY
130
PRINTING BLOCK
148

FIG. 2

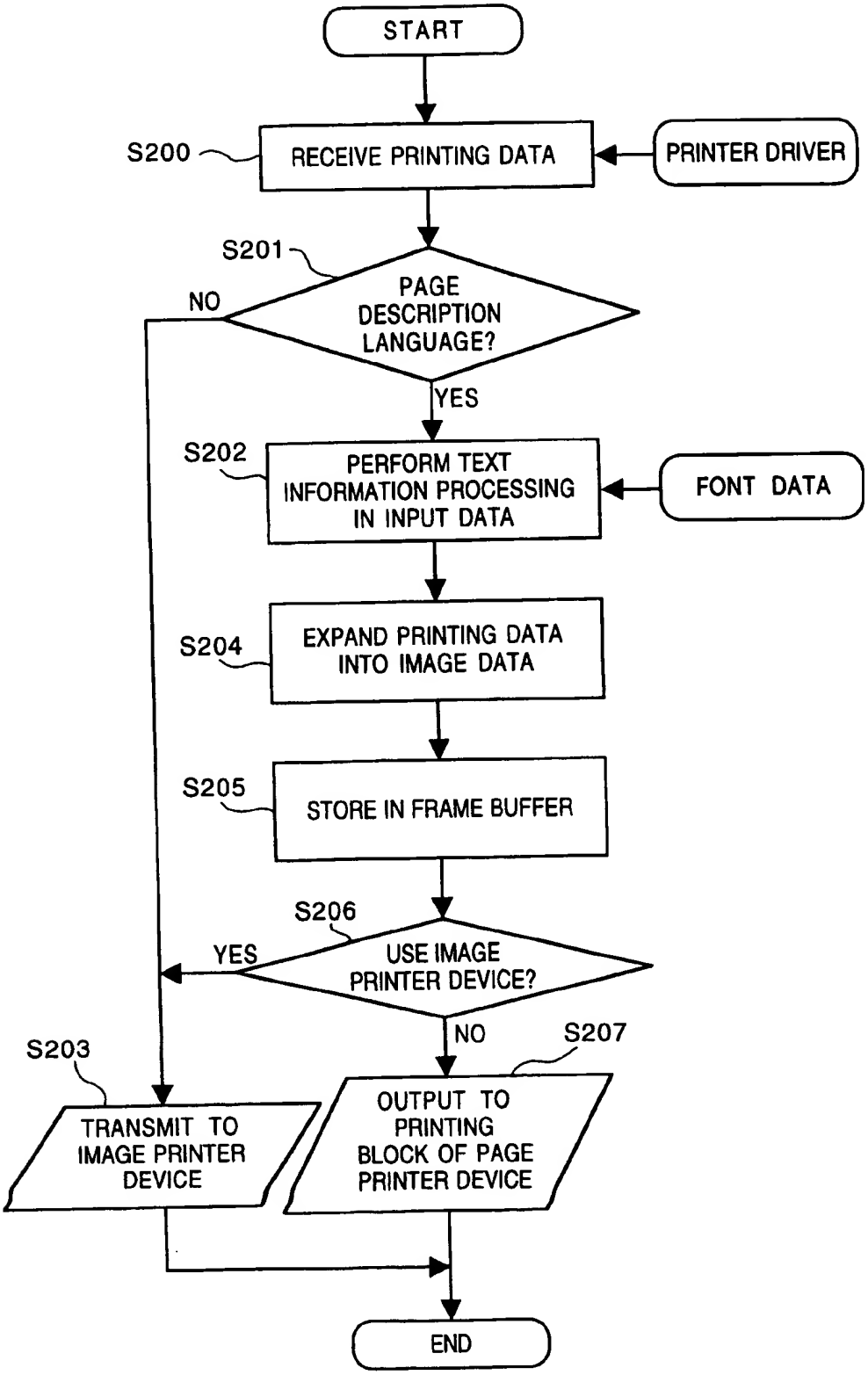

START
S200
RECEIVE PRINTING DATA
PRINTER DRIVER
S201
PAGE DESCRIPTION LANGUAGE?
NO
YES
S202
PERFORM TEXT INFORMATION PROCESSING IN INPUT DATA
FONT DATA
S204
EXPAND PRINTING DATA INTO IMAGE DATA
S205
STORE IN FRAME BUFFER
S206
USE IMAGE PRINTER DEVICE?
YES
NO
S207
S203
TRANSMIT TO IMAGE PRINTER DEVICE
OUTPUT TO PRINTING BLOCK OF PAGE PRINTER DEVICE
END

FIG. 3

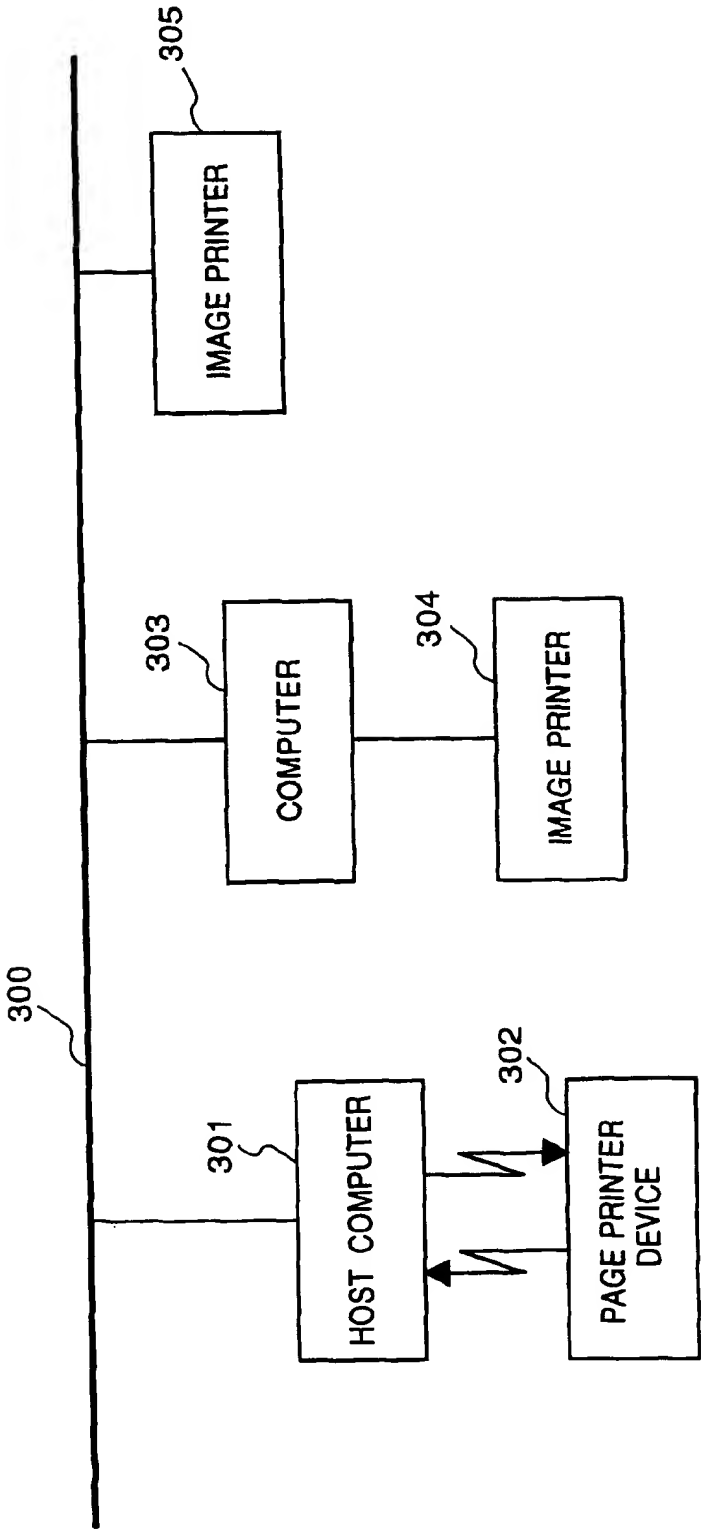

305
IMAGE PRINTER
303
COMPUTER
304
IMAGE PRINTER
300
301
HOST COMPUTER
302
PAGE PRINTER DEVICE

FIG. 4

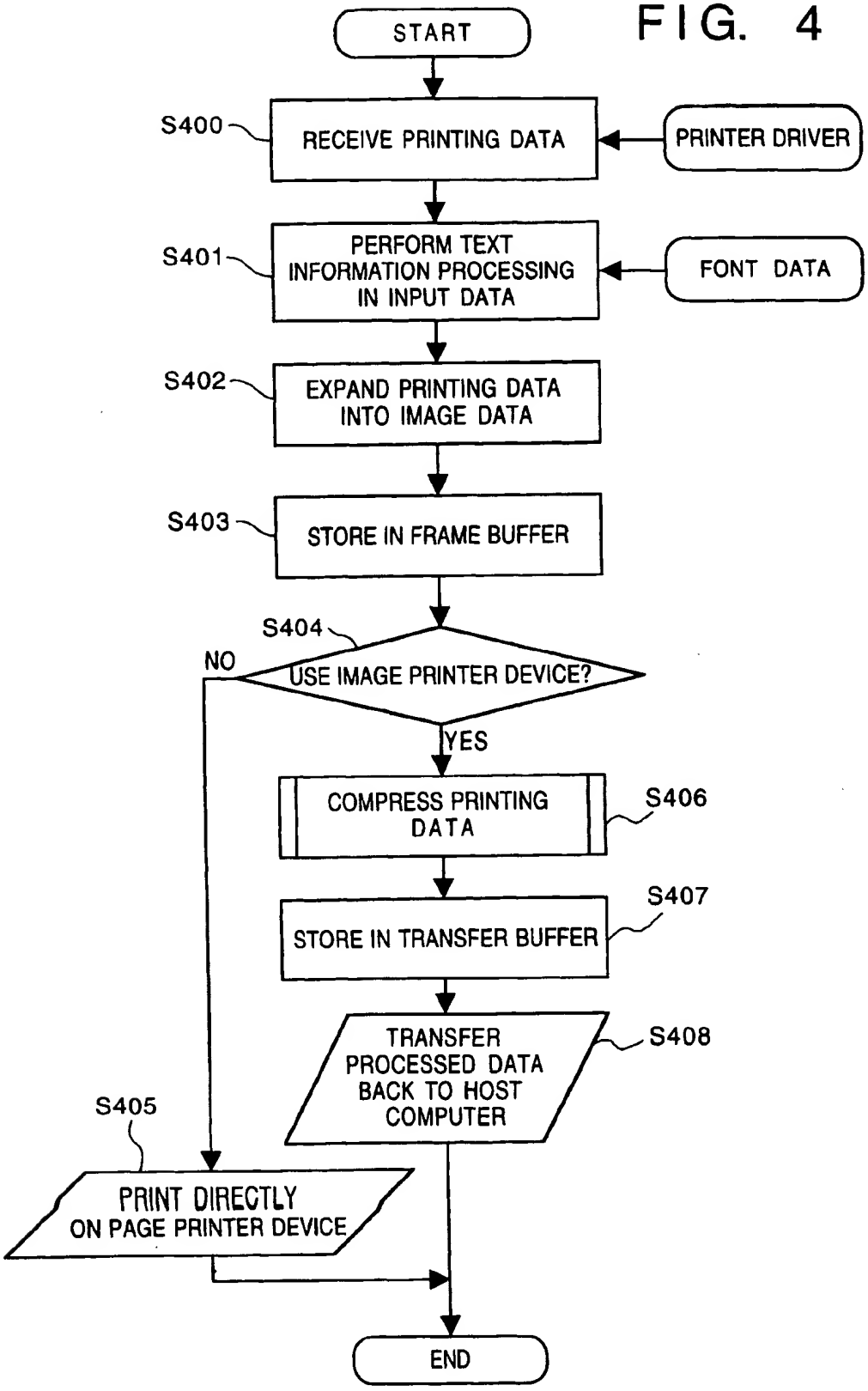

START
S400
RECEIVE PRINTING DATA
PRINTER DRIVER
S401
PERFORM TEXT INFORMATION PROCESSING IN INPUT DATA
FONT DATA
S402
EXPAND PRINTING DATA INTO IMAGE DATA
S403
STORE IN FRAME BUFFER
S404
USE IMAGE PRINTER DEVICE?
NO
YES
COMPRESS PRINTING DATA
S406
S407
STORE IN TRANSFER BUFFER
TRANSFER PROCESSED DATA BACK TO HOST COMPUTER
S408
S405
PRINT DIRECTLY ON PAGE PRINTER DEVICE
END

FIG. 5

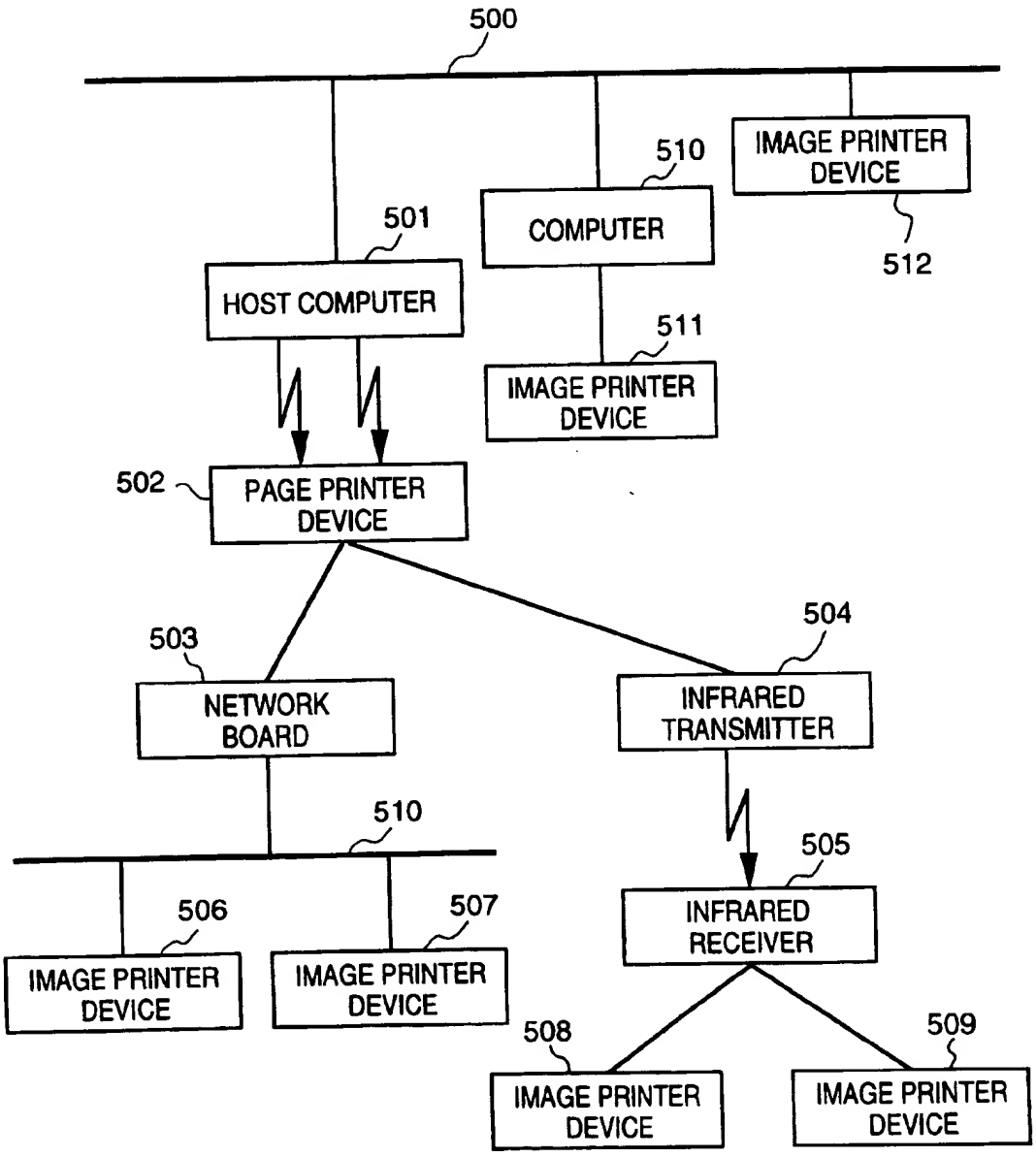

500
510
IMAGE PRINTER DEVICE
501
COMPUTER
512
HOST COMPUTER
511
IMAGE PRINTER DEVICE
502
PAGE PRINTER DEVICE
504
503
NETWORK BOARD
INFRARED TRANSMITTER
510
505
506
507
INFRARED RECEIVER
IMAGE PRINTER DEVICE
IMAGE PRINTER DEVICE
508
509
IMAGE PRINTER DEVICE
IMAGE PRINTER DEVICE

FIG. 6

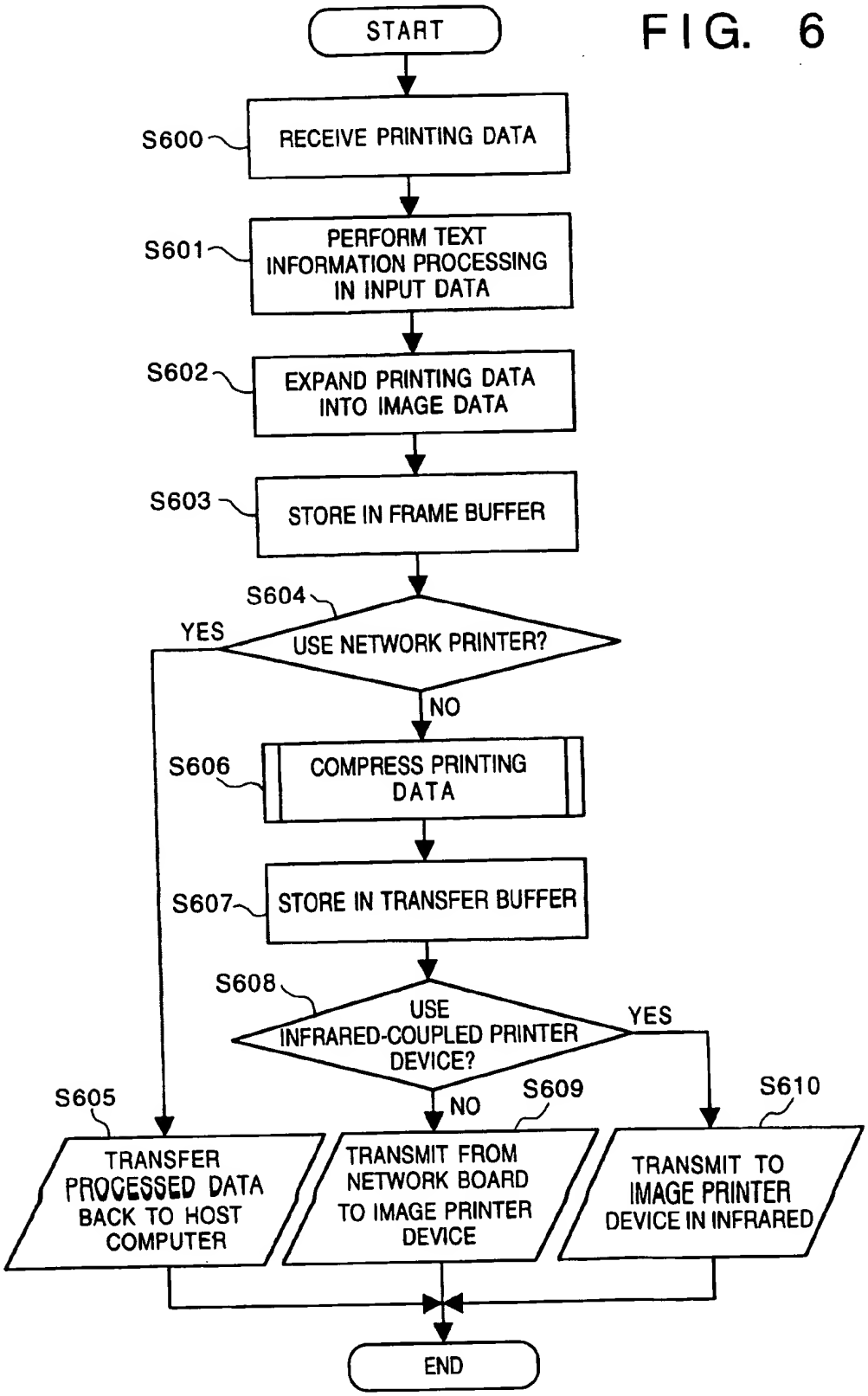

START
S600
RECEIVE PRINTING DATA
S601
PERFORM TEXT INFORMATION PROCESSING IN INPUT DATA
S602
EXPAND PRINTING DATA INTO IMAGE DATA
S603
STORE IN FRAME BUFFER
S604
USE NETWORK PRINTER?
YES
NO
S606
COMPRESS PRINTING DATA
S607
STORE IN TRANSFER BUFFER
S608
USE INFRARED-COUPLED PRINTER DEVICE?
YES
NO
S605
S609
S610
TRANSFER PROCESSED DATA BACK TO HOST COMPUTER
TRANSMIT FROM NETWORK BOARD TO IMAGE PRINTER DEVICE
TRANSMIT TO IMAGE PRINTER DEVICE IN INFRARED
END

FIG. 7

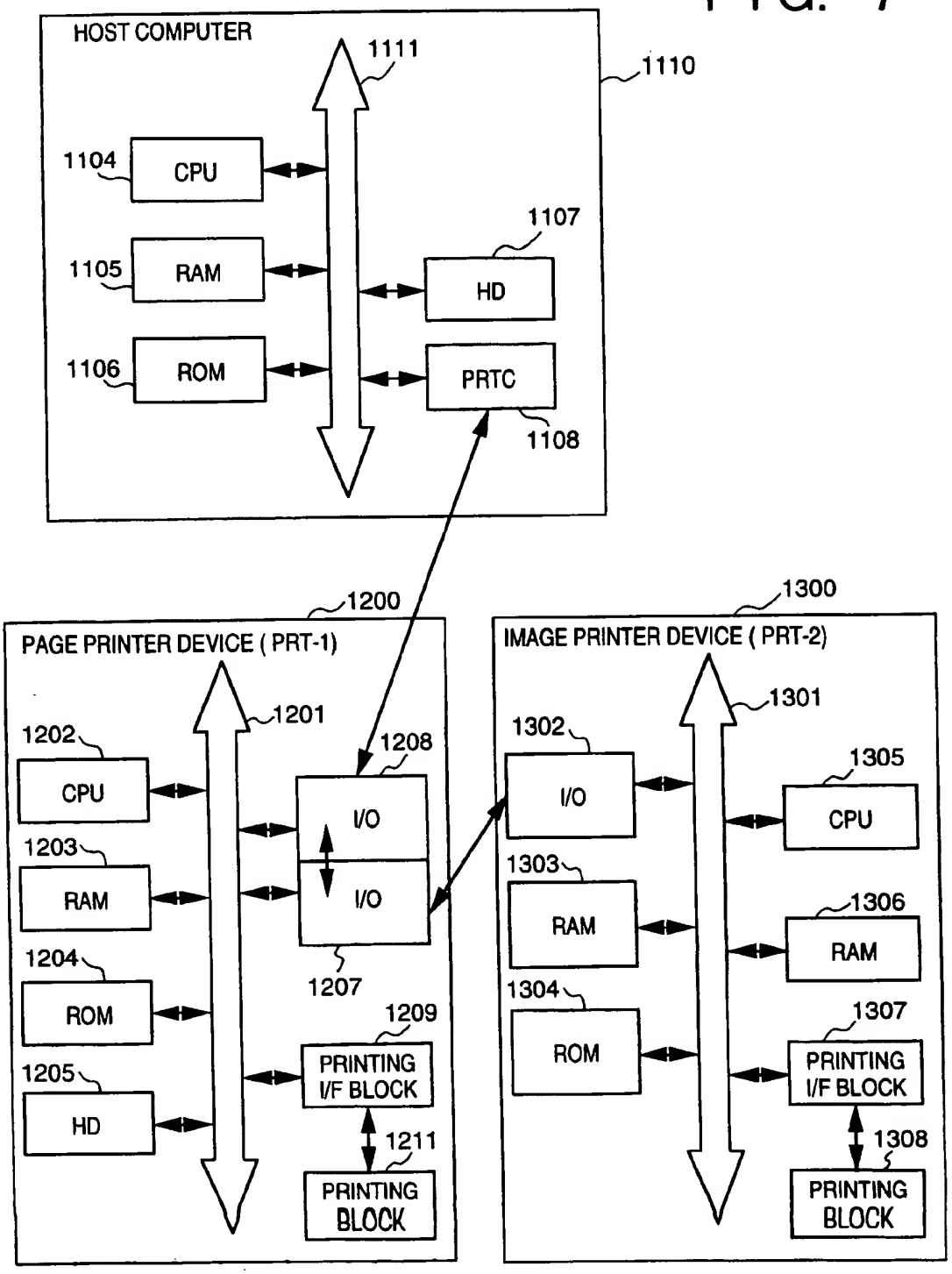

HOST COMPUTER
1111
1110
1104
CPU
1107
1105
RAM
HD
1106
ROM
PRTC
1108
1200
PAGE PRINTER DEVICE (PRT-1)
1300
IMAGE PRINTER DEVICE (PRT-2)
1201
1301
1202
1208
1302
1305
CPU
I/O
I/O
CPU
1203
1303
RAM
I/O
RAM
1306
RAM
1204
1304
ROM
1207
1307
ROM
1209
PRINTING I/F BLOCK
PRINTING I/F BLOCK
1205
HD
1211
1308
PRINTING BLOCK
PRINTING BLOCK

FIG. 8

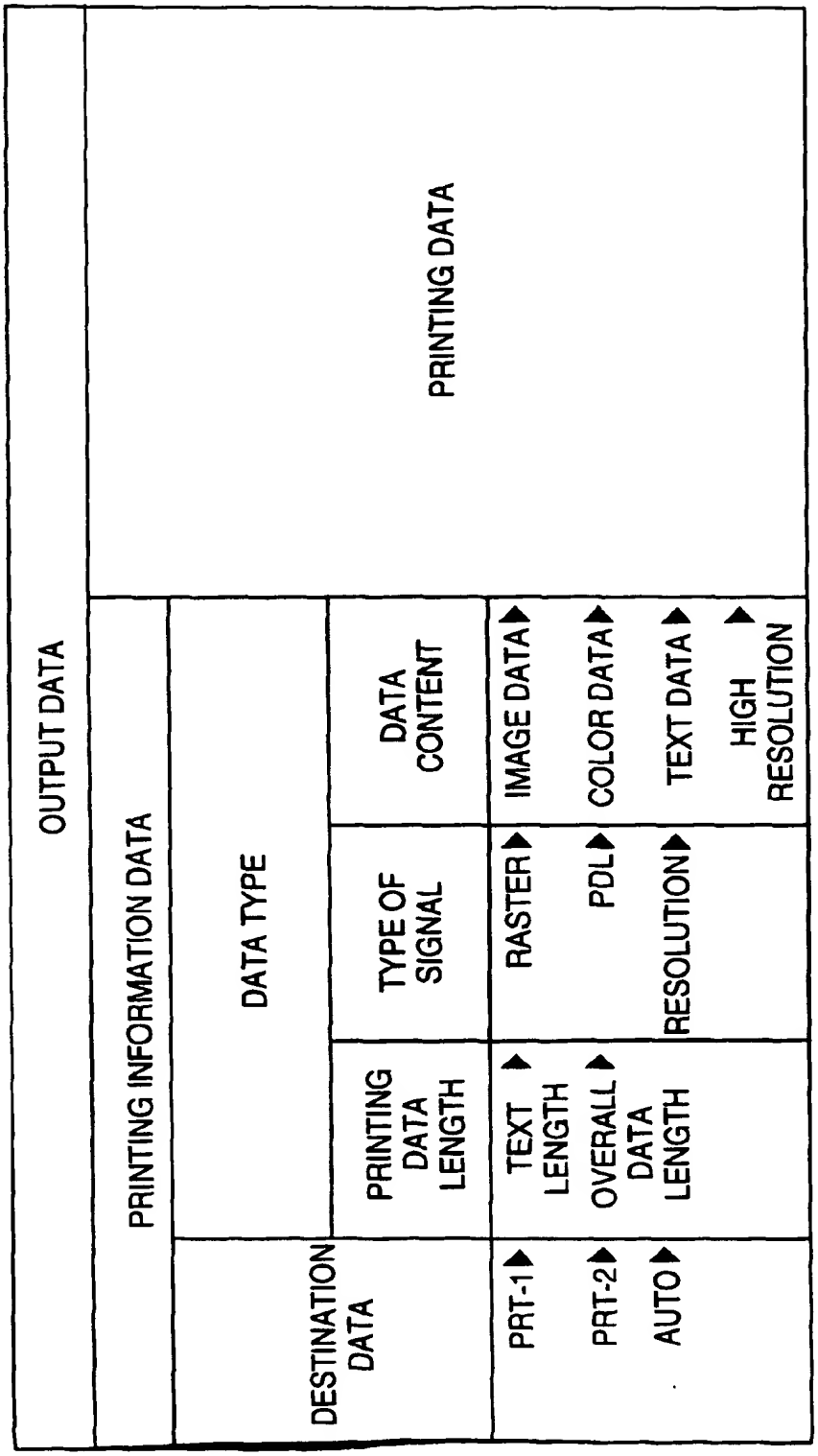

OUTPUT DATA
PRINTING INFORMATION DATA
DATA TYPE
DESTINATION DATA
PRINTING DATA LENGTH
TYPE OF SIGNAL
DATA CONTENT
PRT-1
PRT-2
AUTO
TEXT LENGTH
OVERALL DATA LENGTH
RASTER
PDL
RESOLUTION
IMAGE DATA
COLOR DATA
TEXT DATA
HIGH RESOLUTION
PRINTING DATA

FIG. 9

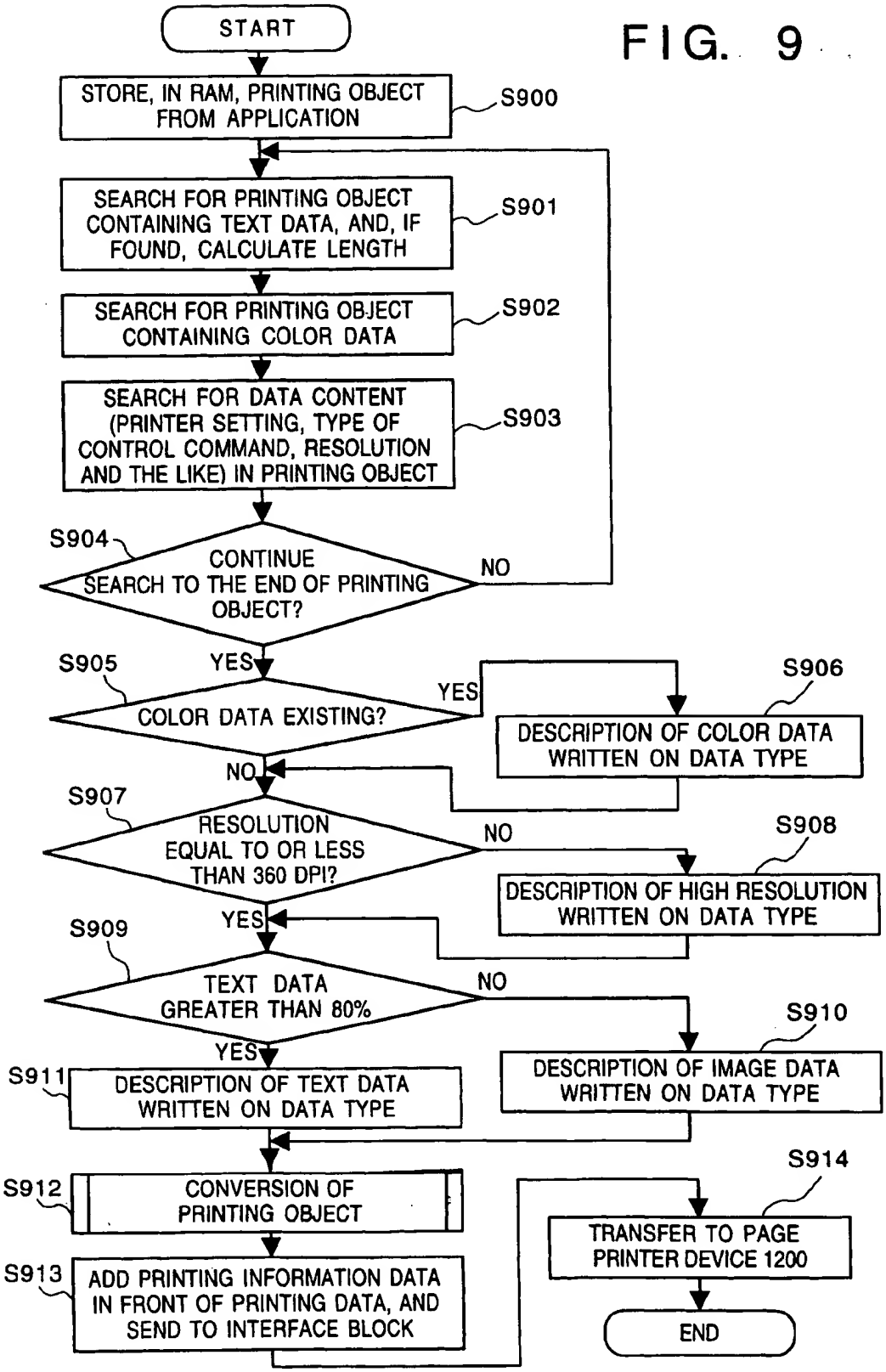

START
STORE, IN RAM, PRINTING OBJECT FROM APPLICATION
S900
SEARCH FOR PRINTING OBJECT CONTAINING TEXT DATA, AND, IF FOUND, CALCULATE LENGTH
S901
SEARCH FOR PRINTING OBJECT CONTAINING COLOR DATA
S902
SEARCH FOR DATA CONTENT (PRINTER SETTING, TYPE OF CONTROL COMMAND, RESOLUTION AND THE LIKE) IN PRINTING OBJECT
S903
S904
CONTINUE SEARCH TO THE END OF PRINTING OBJECT?
NO
YES
S905
COLOR DATA EXISTING?
YES
S906
DESCRIPTION OF COLOR DATA WRITTEN ON DATA TYPE
NO
S907
RESOLUTION EQUAL TO OR LESS THAN 360 DPI?
NO
S908
DESCRIPTION OF HIGH RESOLUTION WRITTEN ON DATA TYPE
YES
S909
TEXT DATA GREATER THAN 80%
NO
S910
DESCRIPTION OF IMAGE DATA WRITTEN ON DATA TYPE
YES
S911
DESCRIPTION OF TEXT DATA WRITTEN ON DATA TYPE
S912
CONVERSION OF PRINTING OBJECT
S913
ADD PRINTING INFORMATION DATA IN FRONT OF PRINTING DATA, AND SEND TO INTERFACE BLOCK
S914
TRANSFER TO PAGE PRINTER DEVICE 1200
END

FIG. 10

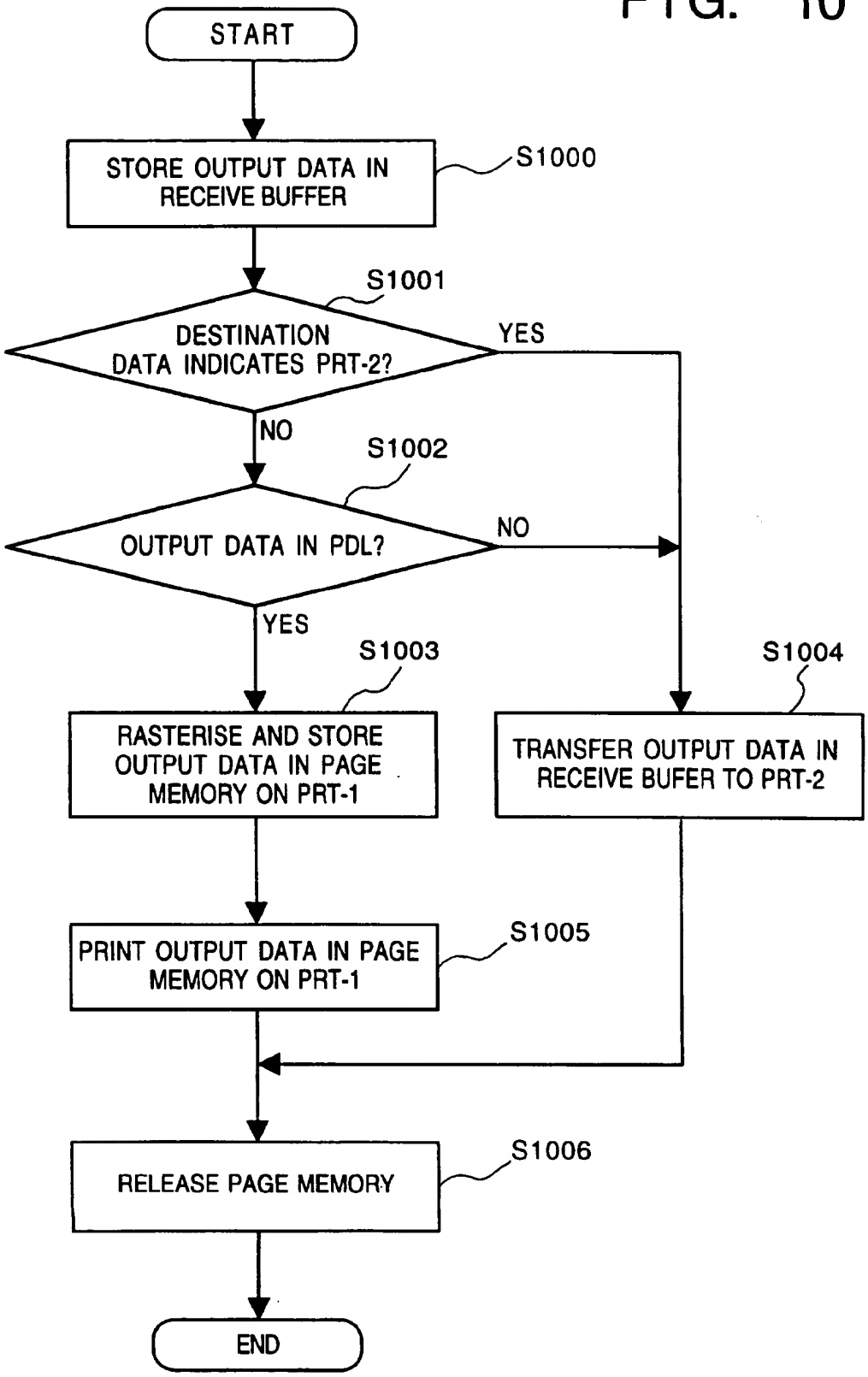

START
STORE OUTPUT DATA IN RECEIVE BUFFER
S1000
S1001
DESTINATION DATA INDICATES PRT-2?
YES
NO
S1002
OUTPUT DATA IN PDL?
NO
YES
S1003
S1004
RASTERISE AND STORE OUTPUT DATA IN PAGE MEMORY ON PRT-1
TRANSFER OUTPUT DATA IN RECEIVE BUFER TO PRT-2
PRINT OUTPUT DATA IN PAGE MEMORY ON PRT-1
S1005
RELEASE PAGE MEMORY
S1006
END

FIG. 11

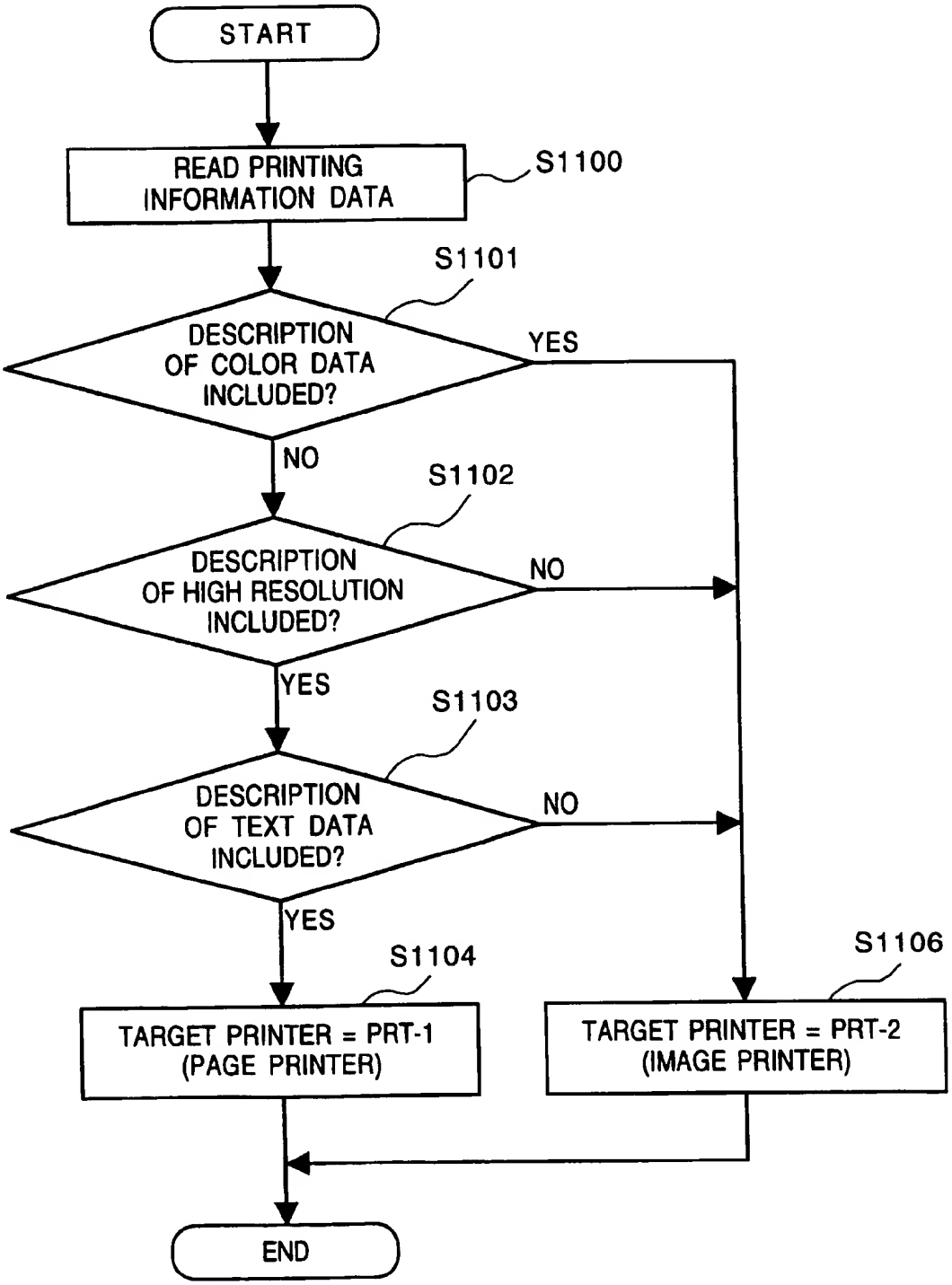

START
READ PRINTING INFORMATION DATA
S1100
S1101
DESCRIPTION OF COLOR DATA INCLUDED?
YES
NO
S1102
DESCRIPTION OF HIGH RESOLUTION INCLUDED?
NO
YES
S1103
DESCRIPTION OF TEXT DATA INCLUDED?
NO
YES
S1104
TARGET PRINTER = PRT-1 (PAGE PRINTER)
S1106
TARGET PRINTER = PRT-2 (IMAGE PRINTER)
END

FIG. 12

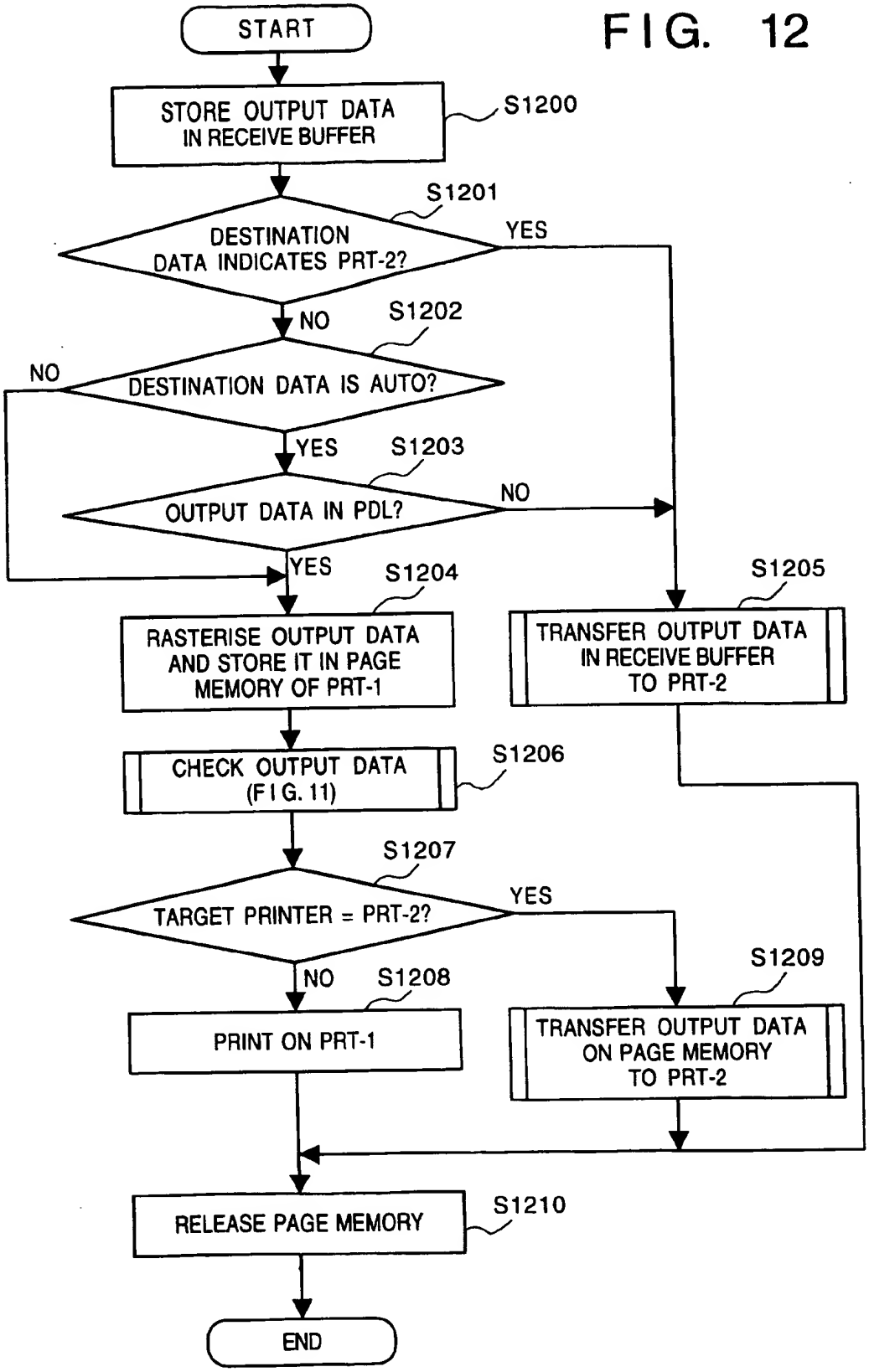

START
STORE OUTPUT DATA IN RECEIVE BUFFER
S1200
S1201
DESTINATION DATA INDICATES PRT-2?
YES
NO
S1202
DESTINATION DATA IS AUTO?
NO
YES
S1203
OUTPUT DATA IN PDL?
NO
YES
S1204
RASTERISE OUTPUT DATA AND STORE IT IN PAGE MEMORY OF PRT-1
S1205
TRANSFER OUTPUT DATA IN RECEIVE BUFFER TO PRT-2
CHECK OUTPUT DATA (FIG. 11)
S1206
S1207
TARGET PRINTER = PRT-2?
YES
NO
S1208
PRINT ON PRT-1
S1209
TRANSFER OUTPUT DATA ON PAGE MEMORY TO PRT-2
RELEASE PAGE MEMORY
S1210
END

FIG. 13

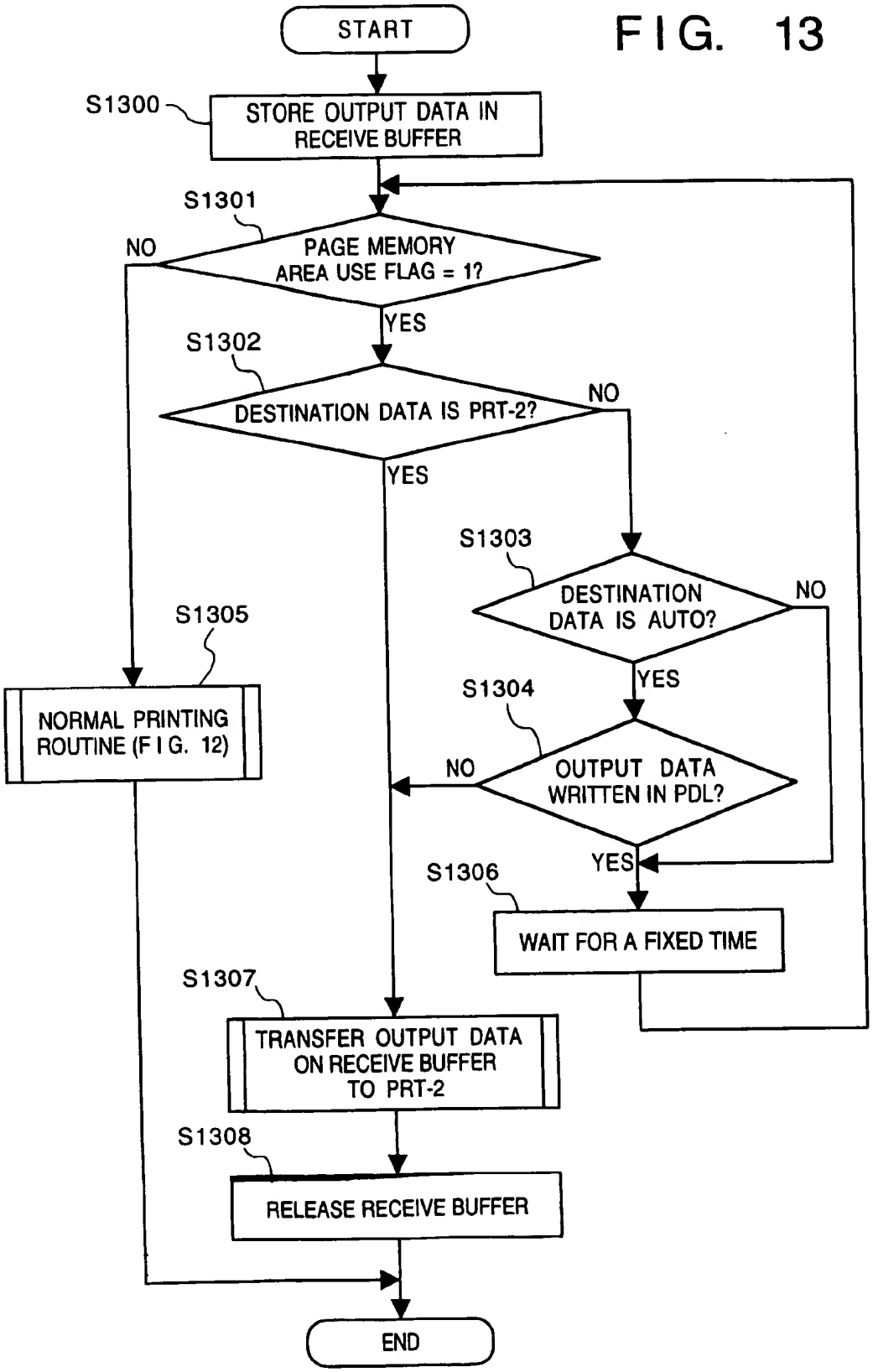
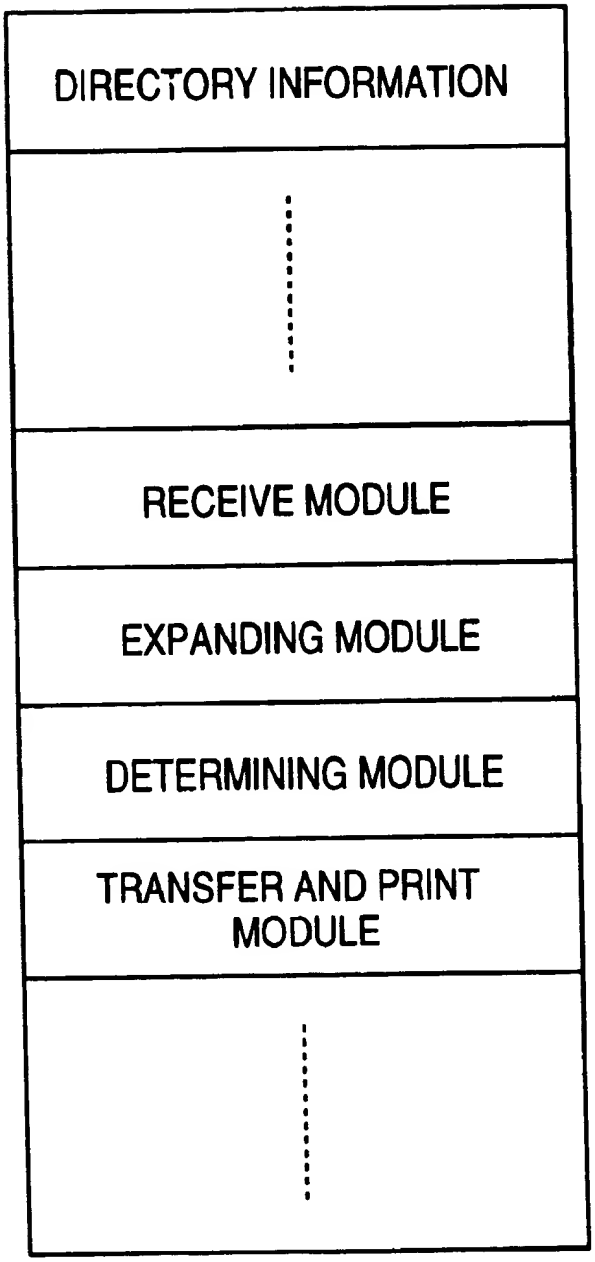

START
S1300
STORE OUTPUT DATA IN RECEIVE BUFFER
S1301
PAGE MEMORY AREA USE FLAG = 1?
NO
YES
S1302
DESTINATION DATA IS PRT-2?
NO
YES
S1303
DESTINATION DATA IS AUTO?
NO
YES
S1304
OUTPUT DATA WRITTEN IN PDL?
NO
YES
S1305
NORMAL PRINTING ROUTINE (FIG. 12)
S1306
WAIT FOR A FIXED TIME
S1307
TRANSFER OUTPUT DATA ON RECEIVE BUFFER TO PRT-2
S1308
RELEASE RECEIVE BUFFER
END

FIG. 14


DIRECTORY INFORMATION
RECEIVE MODULE
EXPANDING MODULE
DETERMINING MODULE
TRANSFER AND PRINT MODULE

INFORMATION PROCESSING SYSTEM

This application is a continuation of application Ser. No. 08/568,320 filed Dec. 6, 1995.

BACKGROUND OF THE INVENTION

The present invention relates to an information processing system that comprises an information processing apparatus such as a personal computer, a workstation or the like, and at least two printer devices for handling printing information delivered by the information processing apparatus.

DESCRIPTION OF THE RELATED ART

Well known as printers in the prior art are image printers that print the image data received from an external instrument such as a host computer or the like, and page printers that receive print data expressed in page description language (also referred to as PDL) and expands it to a bit image to print it.

Printers that have not been available in the prior art are those that offer both the function of printing an image data as it is and the function of receiving and printing the page description language and the like. In particular, the image printer that receives and prints an image data cannot be additionally provided with the function of the page printer, and thus the image printer remains incapable of page printing.

In the printing control method employed in the prior art printers and printing systems, the image printer incorporates no page description language and the like, and thus an image data should be expanded on a host computer side and then be transferred line by line to the printer. The image printer in the prior art cannot share fonts with a printer that has a page description language and the like.

In the printing control method employed in the prior art printers and printing systems, the page printer is not provided with an interface for connection with another printer.

Since the prior art printer is limited in communications method, such as to an RS-232C serial interface, it suffers the following inconveniences.

(1) When the printer receives information from an external apparatus such as a host computer, the communication with the host computer is performed in such a limited way as an RS-232C serial interface. Thus, the prior art printer is not compatible with any system that works on a parallel interface such as Centronics parallel interface that is widely used for communications between printers and host computers.

(2) If an information system operates with a page printer having a page description language and the like and an image printer, both types of printers have to be separately connected to the information system.

Furthermore, in the printing control method employed in the prior art printer or printing system, the image printer has no PDL. The host computer must rasterise its output data into image data, and transmit it to the image printer on a line-by-line basis. For this reason, the host computer is provided rasterising capability. In particular, the image printer that receives color image data and prints a color image has room for improvement in terms of process speed and the workload that is shouldered by the host computer, because the host computer is forced to rasterise a vast amount of color output data.

There have not existed prior art printers that are selectively switched, according to the type of an input to them,

between the function of providing an economical color printing an image printer offers and the function of providing a high resolution printing by means of PDL in the way a page printer works.

Furthermore, when the prior art printer suffers any fault in its printing block, such as paper jamming or running out of toner, it must be re-started and data that was suspended in the middle of transmission must be retransmitted.

SUMMARY OF THE INVENTION

The present invention has been developed to solve the above problems, and it is an object of the present invention to provide an information processing system that reduces printing workload in its information processing apparatus.

It is another object of the present invention to provide a printer that has the function of expanding into an image data the printing data received in page description language from the information processing apparatus and outputting the image data.

To achieve the above objects, the information processing system of the present invention is organized as follows.

The information processing system, constructed of an information processing apparatus and at least two printer devices having different interfaces, comprises:

receiving means for receiving printing information through a first interface,

expander means for expanding into an image data the printing information received from the receiving means, and

transmitting means for transmitting through a second interface the image data expanded by the expander means.

In the above arrangement, the printing information is received through the first interface, the printing information is expanded into the image data, and the expanded image data is transmitted through the second interface.

Other objects of the present invention will become apparent from the drawings and description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing the construction of a printer system of an embodiment 1 of the present invention.

FIG. **2** is a flow diagram showing the printing process of the embodiment 1.

FIG. **3** is a block diagram showing the construction of an embodiment 2 of the present invention.

FIG. **4** is a flow diagram showing the printing process of the embodiment 2.

FIG. **5** is a block diagram showing the construction of an embodiment 3 of the present invention.

FIG. **6** is a flow diagram showing the printing process of the embodiment 3.

FIG. **7** is a block diagram showing generally the construction of a printer system of an embodiment 4 of the present invention.

FIG. **8** is a block diagram showing the output data structure of the embodiment 4 of the present invention.

FIG. **9** is a flow diagram showing the output data forming process of the printer driver of the embodiment 4 of the present invention.

FIG. **10** is a flow diagram showing the printing process of the page printer according to the embodiment 4 of the present invention.

FIG. **11** is a flow diagram showing the output data checking process of the page printer according to an embodiment 5 of the present invention.

FIG. **12** is a flow diagram of the printing process of the page printer according to the embodiment 5 of the present invention.

FIG. **13** is a flow diagram showing the printing process of the page printer according to a seventh embodiment of the present invention, wherein the destination of the output data is selectively switched.

FIG. **14** shows the memory map of the modules stored in a memory medium.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiment 1

Referring now to the drawings, preferred embodiments of the present invention are discussed.

FIG. **1** is the block diagram showing the printer system of the embodiment 1, which comprises a host computer **1**, a page printer device **120**, and an image printer device **140**.

A host computer **100** in FIG. **1** comprises CPU **104** for processing, according to a document processing program, a document containing a mixture of drawings, images, characters, tables and the like, RAM **105** as the main memory for the host computer **100** for serving as the working area for the CPU **104**, ROMs **106** for storing the program for the CPU **104**, a keyboard controller (KBC) **107** for controlling inputs from the keyboard (KB) **101** or an unshown pointing device, a CRT controller (CRTC) **108** for controlling the display of a CRT display (CRT) **102**, a memory controller (MC) **109** for controlling access to an external memory **103** such as a hard disk (HD) or a floppy disk (FD) that stores a boot program, a variety of applications, font data, user files, edit files and the like, and a printer controller (PRTC) **110** for controlling communications via a predetermined bidirectional interface (I/F) with a page printer device to be described later.

The CPU **104** controls generally a plurality of devices that are coupled to a CPU bus **111**, while feeding printing data to the page printer device to be described later. In addition to a program ROM, the ROMs **106** comprise a font ROM for storing font data for use in document processing, and a data ROM for storing a diversity of data used in document processing.

The page printer device **120** comprises an input/output block **121** for controlling communications with the host computer **100** through a bidirectional interface, an input/output block **122** for controlling data exchange with an image printer to be described later, an operation block **123** constructed of a plurality of key input sections and a display, a printing interface (I/F) block **124** for outputting printing data to a printing block **130** that prints an image on a recording medium by means of a laser beam, a CPU **125** for controlling generally the page printer device according to a control program or control data to be described later, a RAM **126** that defines an image memory and the working area that is used by the CPU **125** when it executes its processing, a ROM **127** for storing the control program of the CPU **125**, font data and a diversity of data, and a memory controller (MC) **128** for controlling access to an external memory **129**.

The image printer device **140** comprises a CPU **141** for performing controlling according to a control program and control data, a RAM **142** that serves as a working area used by the CPU **141** when it executes its processing, a ROM **143** for storing the control program of the CPU **141** and control data, an input/output block **144** for controlling data exchange with the page printer device **120**, and a printing I/F block **145** for outputting printing data to a printing block **148** which prints an image data onto a recording medium by means of a laser beam.

FIG. **2** is the flow diagram of the printing process of the page printer device **120** of the embodiment 1. The program for this processing is stored in the ROM **127** and executed under the control of the CPU **125**.

In the initialization process at power-up of the system, a determination is made of whether the image printer device **140** is connected to the page printer device **120**. When both are connected, information about the type of the image printer and the type of its control code processing program is transferred to the host computer **100** via the bidirectional interface.

Next, when the printing data is received from the host computer **100** via the printer driver of the PRTC **110** at step **S200**, the process goes to step **S201** where a determination is made of whether the printing data is either the image data for the image printer device **140** or a page description language. If it is the image data, the process goes to step **S203**, where the image data is transferred to the image printer device **140** via the input/output blocks **122**, **144**.

If the printing data is the page description language at step **S201** on the other hand, the process goes to step **S202**, where text information processing of the page description language is performed referring to the font ROM **106** or the like. The process goes step **S204**, where the printing data is expanded to an image data. At step **S205**, the expanded data is stored in a frame buffer. At step **S206**, referring to printing status, a determination is made of whether to output the image data to the printing block **130** for printing or to transfer the image data to the image printer device **140** via the input/output blocks **122**, **144**. Specifically, when the printing block **130** of the page printer device **120** is now printing, the process goes to step **S203**, where the image data is transferred to the printing block **148** of the image printer device **140**.On the other hand, when the page printer device **120** is ready for printing, the process goes to step **S207**, where the image data is transferred to the printing block **130** via the printing I/F block **124**. Other status may be factored into the determination at step **S206**. For example, the status of the image printer **140** or the destination of the output specified by the host computer **100** may be considered in the determination at step **S206**.

The embodiment 1 of the present invention offers the function in which the page printer device expands to the image data the printing data in the page description language received from the host computer and outputs the image data to the image printer device. Thus, the workload of the host computer is reduced.

Embodiment 2

Referring to drawings, the embodiment 2 of the present invention is now discussed.

FIG. **3** is the block diagram showing the construction of the printer system of the embodiment 2. Connected to a network **300** in the embodiment 2 are a host computer **301**, a computer **303**, and an image printer device **305** for the network. A page printer device **302** is connected to the host computer **301** via a bidirectional interface. An image printer device **304** is connected to the computer **303**.

The host computer **301**, page printer device **302** and image printer device **304** in the embodiment 2 remains

unchanged in their construction from those already described with reference to the embodiment 1.

FIG. **4** shows the flow diagram showing the printing process of the page printer device **302** of the embodiment 2. The program of process steps is stored in the ROM and is executed under the control of the CPU.

When the page printer device **302** receives the printing data at step **S400**, the process goes to step **S401**, where text information processing is performed referring to the font ROM and the like. The process goes to step **S402**, where the printing data is expanded to an image data. At step **S403**, the expanded image data is stored onto a frame buffer.

Next, at step **S404**, a determination is made of whether the destination of the image data is the image printer device **305** existing on the network **300** or the image printer device **304** connected to the computer **303**. When the destination is neither of both image printer devices, the process goes to step **S405**, where the image data is directly printed on the page printer device. When the destination is either the image printer device **304** or image printer device **305**, the process goes to step **S406**, where the image data that is expanded at step **S402** is compressed using a known image compression technique. At step **S407**, the compressed image data is stored in a transfer buffer. At step **S408**, the compressed image data is transferred to the host computer **301** via a bidirectional interface.

The host computer **301** transmits the image data, into which the page printer device **302** has converted the printing data, via the network to either the network image printer device **305** or the image printer device **304** connected to the computer **303** on the network.

According to the embodiment 2, the printing process is performed by the page printer rather than by the host computer. Thus, the workload of the host computer is reduced.

Embodiment 3

Referring to drawings, the embodiment 3 of the present invention is now discussed.

FIG. **5** is the block diagram showing the construction of the printer system of the embodiment 3. In the embodiment 3, a page printer device **502** is connected via a bidirectional interface to a host computer **501** on a network **500**. An infrared transmitter **504** is connected to the page printer device **502**. An infrared receiver **505** connects to a plurality of image printers **508, 509**. The page printer **502** connects to a network board **503**, and its network **510** connects to a plurality of image printers **506, 507**.

The host computer **501**, page printer **502** and each of the image printers in the embodiment 3 remain unchanged in their construction to those described with reference to the preceding embodiments, and their explanation will not be repeated.

FIG. **6** is the flow diagram of the page printer device **502** of the embodiment 3.

In the initialization process at power-up of the system, the page printer device **502** transfers to the host computer **501** the information indicative of how the image printer devices **506, 507** and the like are connected to the network board **503** connected to the page printer device **502**. When printing data is received from the host computer **501** at step **S600**, the process goes to step **S601**, where text information processing is performed referring to the font ROM. At step **S602**, the printing data is expanded to an image data. At step **S603**, the expanded image data is stored in the frame buffer.

At step **S604**, a determination is made of whether the printer device that is now going to print is the image printer devices **511, 512** under the control of the host computer **501**. When printing is performed by the image printer devices on the network **500**, the process goes to step **S605**, where processed data is fed back to the host computer **501**. The host computer **501** transmits the data to the image printer devices **511, 512**.

On the other hand, when the determination at step **S604** reveals that the printer devices under the control of the host computer **501** are not used, the process goes to step **S606**, where printing data is compressed using a known compression technique. At step **S607**, the compressed image data is stored in a transfer buffer. At step **S608**, a determination is made of whether to use the image printer devices **506, 507** that are connected to the network **510** via the network board **503**, or to use the infrared-coupled image printer devices **508, 509**. When the image printer devices **506, 507** on the network **510** are used, the process goes to step **S609**, where the image data is transferred via the network board **503** to the image printer devices **506, 507** for printing. When the infrared-coupled image printers **508, 509** are used, the process goes to step **S610**, where the infrared transmitter **504** transmits the image data. The image printer devices **508, 509** print out the image data received by the infrared receiver **505**.

According to the embodiment 3, the page printer is provided with a networking function. Thus, the processed image data is directly transferred to the image printer devices, and the printing process that would be otherwise performed by the host computer is accomplished by the page printer device.

The present invention may be implemented in a multi-device system as well as a single-device system. The present invention may be implemented by loading a software program to a multi-device system or a single-device system.

As described above, the above embodiments provide the printing method and device of the information processing system with reduced workload in printing process of the information processing apparatus.

Embodiment 4

FIG. **7** is the block diagram showing a host computer **1100** and the printer system of the embodiment 4 comprising a page printer device **1200** and an image printer device **1300**.

In FIG. **7**, the host computer **1100** transmits its output data to the page printer device **1200** of this embodiment. Input/output or interface blocks **1108, 1206** control data transfer between the page printer **1200** and the host computer **1100**. The CPU **1202** in the page printer device **1200** performs a diversity of control according to the control program stored in ROM **1204** and control data, and controls generally the page printer device **1200**. Unless otherwise particularly noted in the description that follows, the host computer is controlled by CPU **1104**, the page printer device **1200** by CPU **1202**, and the image printer device **1300** by CPU **1305**. RAM **1203** has memory areas assigned as a receive buffer for receiving data and a page memory area for rasterising output data. The RAM **1203** also stores data handled in the course of performing a diversity of printing control. Designated **1211** is a printing block which outputs printing data stored in the RAM **1203**. Input/output blocks or interface blocks **1207, 1302** control data transfer between the page printer device **1200** and the image printer device **1300**. The image printer device **1300** receives at its interface block **1302** the output data from the page printer device **1200**.

FIG. 8 shows the output data structure according to the embodiment 4. As shown, the output data contains printing data and printing information data on its header portion. The printing information data contains the destination about a target printer and the data type of the printing data. The destination provides the name of the printer an application specifies or the indication of printer automatic selection mode (hereinafter referred to as AUTO).

The data type provides the description regarding printing data length, the type of printer control signal, and data content. The printing data length specifies the overall printing data length and the length of text data if included therein.

As the output data, the printing data associated with the printing information is transferred to the printer device **1200**. The table below shows an example of the content of the printing information data.

Example of printing information data

Example	Destination data	Printing data length	Printing signal	Data content
Printing a color image by image driver	PRT-2	Overall: xxxx Text:0	PDL (color) 360 dpi	Image data Color data
Printing color text in AUTO mode	AUTO	Overall: xxxx Text:xxxx	PDL (color) 600 dpi	Text, Text data High resolution

FIG. 9 shows the output data forming flow diagram of the printer driver software (hereinafter referred to as printer driver) in the host computer **1100**. The printer driver is loaded from HD **1107** to RAM **1105** in the host computer. It should be noted that each step in the following process is performed according to the printer driver unless otherwise particular stated. At step **S900**, the printing object given by an application is stored in the receive buffer of the RAM **1105**. At step **S901**, to form printing information data, the printing object is checked to see if it contains text data. If the printing object contains text data, the number of bytes of the text data is added to the text data length. At step **S902**, the printing object is searched to see if it contains color data. At step **S903**, the content of the printing object is checked. The content includes the destination data, type of signal data, resolution data and the like. The printing object normally includes these data, and thus they are directly arranged in each respective part of the data type. Among them, the resolution data is arranged in the type of signal area as a resolution value. At step **S904**, a check is made of whether or not a series of steps **S901** through **S903** are completed, by recognizing the end of the printing object.

If the printing object contains at least one color data, a description of the color data is provided in the data content of the data type at step **S906**. The resolution value in the type of signal of the data type that is derived from the printing object at step **S903** is compared with 360 dpi at step **S907**. If it is greater than 360 dpi, the description of high resolution is included in the data content of the data type at step **S908**. At step **S909**, whether or not the ratio of the text data length to the overall data length in the output data is greater than 80% is calculated. If the text data is smaller than 80%, the description of image data is included in the data content of the data type at step **S910**. If the text data is 80% or greater, the description of the text data is included in the data content of the data type at step **S911**. At step **S912**, all the printing object stored in the RAM **1105** is converted to PDL. At step **S913**, the printing information data is arranged ahead of the printing data in the output data, which is then transferred to the interface block **1108**. At step **S914**, the output data is transmitted to the page printer device **1200** via a Centronics parallel interface line.

FIG. 10 is the flow diagram showing the printing process of the page printer device **1200** (hereinafter referred to as PRT-1) of this embodiment. The program for this process is stored in ROM **1204**, and is executed under the control of CPU **1202**. The printer system further comprises as a terminal printer the image printer device (hereinafter referred to as PRT-2) connected to PRT-1.

At step **S1000**, the printing process starts with receiving at the receive buffer assigned in RAM **1203** the output data processed by the printer driver in RAM **1105** of the host computer **1100**. At step **S1001**, a determination is made of whether or not the destination data in the printing information data at the header portion of the output data is PRT-2. If the destination data is PRT-2, the output data in the receive buffer assigned in RAM **1203** is transferred to PRT-2 via the interface blocks **1207**, **1302** at step **S1004**. If the destination data is not PRT-2, the type of signal of the data type is checked to see if the output data is described in PDL at step **S1002**. If it is not described in PDL, the process goes to step **S1004**, where the output data on the receive buffer assigned in RAM **1203** is transferred to PRT-2. If it is described in PDL, on the other hand, the output data is rasterised and stored on the page memory area assigned in RAM **1203** in PRT-1 at step **S1003**. At step **S1005**, the output data rasterised is printed on PRT-1. At step **S1006**, the page memory area assigned in RAM **1203** is released.

Embodiment 5

The embodiment 5 of the present invention is now discussed. The construction of the printer system of this embodiment remains unchanged from that in FIG. 7. The output data in printing is formed in the same manner as in the output data forming process employed in the embodiment 4. It should be noted that each step of the following process is executed by CPU **1202** according to the control program stored in ROM **1204** unless otherwise particularly stated. In FIG. 7, the image printer device **1300** (hereinafter PRT-2) is limited to a color image printer. The flow diagram in FIG. 11 is the one for output data checking process, and is integrated into the flow diagram in FIG. 12. FIG. 11 is a detailed flow diagram of step **S1206** in FIG. 12 for output data checking process.

As shown in FIG. 11, of the output data rasterised to the page memory area in RAM **1203** in PRT-1, the printing information data is expanded to RAM **1203**. At step **S1101**, a determination is made of whether the description of color data is included in the data content of the data type in the output data. If there exists the description of color data, the target printer is set to be PRT-2 at step **S1106**. If no description of color data is found, a determination is made of whether the description of high resolution is included in the data content of the data type in the output data at step **S1102**. With no description of high resolution, the target printer is set to be PRT-2 at step **S1106**. If there is the description of high resolution, a determination is made of whether the description of text data is included in the data content of the data type at step **S1103**. If there is the description of text data, the target printer is set be PRT-1 at step **S1104**. With no description of text data, the target printer is set to be PRT-2.

Referring to FIG. **12**, the main process of this embodiment is now discussed. The process starts with receiving the output data at the receive buffer assigned in RAM **1203** at step **S1200** as shown in FIG. **12**. A determination is made of whether or not the destination data of the printing information data is PRT-2 at step **S1201**. If it is PRT-2, the output data on the receive buffer assigned in RAM **1302** is transferred to PRT-2 at step **S1205**. On the other hand, if it is not PRT-2, a determination is made of whether or not the destination data is AUTO at step **S1202**. If the destination data is AUTO, the type of signal of the data type is checked to see if the output data is described in PDL at step **S1203**. If it is not described in PDL, the output data in the receive buffer assigned in RAM **1203** is transferred to PRT-2 at step **S1205**. If the destination data is not AUTO at step **S1202** and if the output data is described in PDL at step **S1203**, the output data is rasterised in PRT-1 at step **S1204**, and then stored in the page memory area assigned in RAM **1203**. The output data is then checked as described with reference to FIG. **11**. At step **S1207**, a determination is made of whether or not the target printer is PRT-2. If it is PRT-2, the output data rasterised and stored on the page memory area assigned to RAM **1203** is transferred to PRT-2 at step **1209**. If it is not PRT-2, printing operation is performed on PRT-1 at step **S1208**. In both cases, the final step is to release the page memory area at step **S1210**.

Embodiment 6

The embodiment 6 of the present invention is now discussed. The construction of the printer system of this embodiment remains unchanged from that in FIG. **7**. Each step in the following process is executed by CPU **1202** according to the control program stored in ROM **1204**, basically in the same way as the embodiment 5. The difference is that step **S1208** in the embodiment 5 in FIG. **12** for printing step on PRT-1 is replaced with print stop step in the event of printing malfunction. The embodiment 6 is now detailed.

The process is performed in PRT-1 as shown in FIG. **12**. When the process goes to step **S1208**, the process of the embodiment 6 starts. A determination is made of whether any mechanical error such as paper jamming, running out of toner or paper or the like takes place in the printing block **1211** in PRT-1. If no such error is detected, the normal printing operation identical to step **S1208** in FIG. **12** is performed. If any error is detected, a determination is made of whether or not the output data rasterised remains in its complete form on the page memory area assigned in RAM **1203**. If it remains, the output data rasterised onto the page memory area is transferred to PRT-2. If no data remains, an error message is transmitted to the display panel of the page printer device PRT-1 at step **S1209**.

Finally, the process of the embodiment 6 returns to step **S1210** of FIG. **12** of the embodiment 5, and the page memory area is released.

Embodiment 7

The embodiment 7 of the present invention is now discussed. The construction of the printer system remains unchanged from that in FIG. **7**. The program for the process of this embodiment is stored in ROM **1204** and executed by CPU **1202** in the page printer device **1200**, PRT-1. When the page memory area assigned in RAM **1203** in PRT-1 is in use for printing process, controlling is performed with the page memory area use flag of RAM **1203**.

First, the output data is received by the receive buffer assigned in RAM **1203** at step **S1300** as shown in FIG. **13**.

At step **S1301**, the page memory area use flag of RAM **1203** is checked. When it is not set, PRT-1 is not printing, and at step **S1305**, a normal printing routine is performed at step **S1305** as the embodiment 5 in FIG. **12**. When the flag is set, PRT-1 is now printing, and at step **S1302**, a determination is made of whether the destination data of the printing information data is PRT-2. If it is PRT-2, the output data on the receive buffer assigned in RAM **1203** is transferred to PRT-2 at step **S1307**.

If the destination data is found to be not PRT-2 at step **S1302**, a determination is made of whether or not the destination data of the output data is AUTO at step **S1303**. If it is AUTO, the type of signal of the data type is checked to see if the output data is described in PDL at step **S1304**. If it is not described in PDL, the output data on the receive buffer assigned in RAM **1203** is transferred to PRT-2 at step **S1307**.

If the destination data is not AUTO at step **S1303** and if the output data is described in PDL at step **S1304**, the process stays in waiting status for a fixed period of time (2 ms in this embodiment), and then returns to step **S1301**.

The output data on the receive buffer is transferred to PRT-2 at step **S1307**, and then the page memory area is released at step **S1309**.

According to embodiments 4 through 7, the function of checking the printing data specification is incorporated in the system that is made up of the page printer and the image printer, both of which are conventionally separately connected. To print the printing data, the system therefore automatically selects the printer that matches the printing data specification. In particular, when the color image printer is used, the system allows its page printer to rasterise the color output data, even if it is described in PDL (page description language), as long as the page printer is equipped with color compatible PDL, and the color image printer prints a color image. This arrangement thus permits fast printing in a manner that imposes no large workload onto the host computer.

Even when a mechanical trouble such as paper jamming takes place in the page printer, the image printer remains operative in its normal way. When the output data in its entirety remains in the page memory in the page printer device, the output data can be transferred to the image printer. This feature allows the image printer device to print without the need for retransmitting the data from the host computer.

Even when the page printer device is printing one printing data, the image printer device remains capable of printing different printing data if it is image data because it requires no process by the page printer. Thus, both the page printer device and image printer device are substantially concurrently usable.

The prior art Centronics parallel interface allows a single port to service a single type of printer device. According to the printer system of the present invention, a single port is capable of connecting to and servicing two types of printer devices.

Other Embodiment

The present invention can be applied to a system constituted by a plurality of devices (e.g., host computer, interface, reader, printer) or to an apparatus comprising a single device (e.g., copy machine, facsimile).

Further, the object of the present invention can be also achieved by providing a storage medium storing program

codes for performing the aforesaid processes to a system or an apparatus, reading the program codes with a computer (e.g., CPU, MPU) of the system or apparatus from the storage medium, then executing the program.

In this case, the program codes read from the storage medium realize the functions according to the embodiments, and the storage medium storing the program codes constitutes the invention.

Further, the storage medium, such as a floppy disk, a hard disk, an optical disk, a magneto-optical disk, CD-ROM, CD-R, a magnetic tape, a non-volatile type memory card, and ROM can be used for providing the program codes.

Furthermore, besides aforesaid functions according to the above embodiments are realized by executing the program codes which are read by a computer, the present invention includes a case where an OS or the like working on the computer performs a part or entire processes in accordance with designations of the program codes and realizes functions according to the above embodiments.

Furthermore, the present invention also includes a case where, after the program codes read from the storage medium are written in a function extension board which is inserted into the computer or in a memory provided in a function extension unit which is connected to the computer, CPU or the like contained in the function extension board or unit performs a part or entire process in accordance with designations of the program codes and realizes functions of the above embodiments.

In a case where the present invention is applied to the aforesaid storage medium, the storage medium stores program codes corresponding to the flowcharts described in the embodiments. Briefly, the storage medium stores each module shown as an example of a memory map in FIG. **14**. More specifically, program codes which correspond to receive module, expanding module, determining module and transfer and print module, at least, are to be stored in the storage medium.

The present invention may be applied in the existing system of a prior art computer and image printer device by incorporating a newly developed page printer device into the system.

Although the present invention has been described by referring to preferred embodiments thereof, the present invention is not limited to the above embodiments, and it will be understood that a variety of modifications are made without departing from the nature and scope of the invention as set forth in appended claims.

What is claimed is:

1. A printer device comprising:

receiving means for receiving printing information through a first interface;

expander means for expanding into expanded image data the printing information received from said receiving means;

printing means for printing the expanded image data;

transmitting means for transmitting the expanded image data out of said printer device through a second interface different from the first interface; and

determining means for determining, based on the printing information received by said receiving means, whether the expanded image data is to be handled in a first mode or in a second mode,

wherein, in the first mode, the image data expanded by said expander means is printed by said printing means without being transmitted through the second interface, and in the second mode, after the printing information has been expanded into the expanded image data, the image data expanded by said expander means is transmitted by said transmitting means through the second interface without being printed by said printing means.

2. The printer device according to claim **1**, wherein said printer device comprises the second interface, said second interface being connected with another printer device.

3. The printer device according to claim **2**, wherein said printer device further comprises selecting means for selecting one of the first and second modes based on a status of said printing means and a status of the other printer device.

4. The printer device according to claim **1**, wherein said receiving means is capable of receiving a page description language and image data as the printing information.

5. The printer device according to claim **4**, wherein the received printing information is only the page description language.

6. A printing method of a first printer device, said method comprising the steps of:

receiving printing information through a first interface;

expanding the received printing information into expanded image data;

printing the expanded image data, when a first mode of the first printer device is selected;

transmitting the expanded image data out of the first printer device through a second interface different from the first interface; and

determining, based on the printing information received by said receiving step, whether the expanded image data is to be handled in the first mode or in a second mode,

wherein, in the first mode, the image data expanded at said expanding step is printed at said printing step without being transmitted through the second interface, and in the second mode, after the printing information has been expanded into the expanded image data, the image data expanded at said expanding step is transmitted at said transmitting step through the second interface without being printed at said printing step.

7. The printing method according to claim **6**, wherein the first printer device comprises the second interface, the second interface being connected with another printer device.

8. The printing method according to claim **7**, wherein one of the first and the second modes is selected based on a status of the first printing device and a status of the other printer device.

9. The printing method according to claim **6**, wherein in said receiving step, a page description language or image data may be received as the printing information.

10. The printing method according to claim **9**, wherein the received printing information is only the page description language.

11. A printer system constructed of a computer capable of generating page description language output data including printing data, a page printer device connected to the computer that receives the output data from the computer and is capable of rasterizing the received output data, and an image printer device connected to the page printer device,

said printer system being provided with a function of causing said computer to add destination data of a target printer device to a header portion of the output data, the destination data being different from and separate from the printing data in the output data, and causing said page printer device to determine, based on

the destination data received in the output data, whether to print the output data by the page printer device or transfer image data rasterized based on the output data from said page printer device to said image printer device where the output data is printed out.

12. The printer system according to claim 11, wherein said computer checks a characteristic of the output data, the characteristic being at least one of color and image resolution, adds a check result as a data type to the header portion of the output data to form resulting output data, and transfers the resulting output data to said page printer device, and, based on the data type of the output data, said page printer device determines whether to print the output data on its own or to transfer the resulting output data to said image printer device where the output data is printed out.

13. The printer system according to claim 11, wherein said page printer device determines whether or not the rasterized output data remains in a memory area of said page printer device when a mechanical trouble including at least one of a paper jam and running out of toner or paper occurs in a printing block of said page printer device, said page printer device transferring to the image printer device the rasterized output data if the rasterized output data remains in the memory area.

14. The printer system according to claim 11, wherein when said computer gives new output data during a printing operation of said page printer device, said page printer device stores the new output data into a receive buffer of said page printer device, determines whether the new output data is transferable data or not, and, if transferable data, transfers the new output data from the receive buffer to said image printer device to be printed there.

15. A computer program product for operating a printer device, comprising codes for performing the following steps:

receiving printing information through a first interface;

expanding into expanded image data the printing information received at said receiving step;

printing the expanded image data using printing means;

transmitting the expanded image data out of the printer device through a second interface different from the first interface; and

determining, based on the printing information received at said receiving step, whether the expanded image data is to be handled in a first mode or in a second mode,

wherein, in the first mode, the image data expanded at said expanding step is printed by the printing means without being transmitted through the second interface, and in the second mode, after the printing information has been expanded into the expanded image data, the image data expanded at said expanding step is transmitted at said transmitting step through the second interface without being printed by the printing means.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,995,722

DATED : November 30, 1999

INVENTOR(S) : AKIRA KISHIDA

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

COLUMN 1

Line 18, "expands" should read --expand--.

COLUMN 4

Line 31, "goes" should read --goes to--.
Line 40, "140.0n" should read --140. On--.

COLUMN 7

Line 39, "particular" should read --particularly--.

COLUMN 8

Line 2, "object" should read --objects--; and "is" should read --are--.

COLUMN 9

Line 35, "print" should read --a print--.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,995,722

DATED : November 30, 1999

INVENTOR(S) : AKIRA KISHIDA

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

COLUMN 10

Line 60, "Embodiment" should read --Embodiments--.

Signed and Sealed this

Seventh Day of November, 2000

Attest:

Q. TODD DICKINSON

Attesting Officer

Director of Patents and Trademarks